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THE GAS COMPANIES.

THE depressed state of gas shares in the market still continues, and public interest in the electric light has abated but little since our last issue. Everybody is now waiting until Mr. Edison shall throw off the cloak of mystery and unveil the secret of his electric light.* The rumblings of alarm and cries of dismay which resounded on every side a fortnight ago have only given place to a calm suspense; and many people feel that the fate of the gas companies may be trembling in the scales. Very little sympathy is expressed for these companies, as companies; on the contrary, there are few consumers of gas, both great and small, who have not suffered some grievance at their hands, and who do not hail the advance of the electric light with considerable satisfaction. Bad gas, tyrannous measures, and faulty meters, are all keenly remembered against the giant Monopoly which now seems tottering to his fall. Apart from the management, however, the present is a most serious time for the shareholders of the gas companies. It is calculated that there is no less than £130,000,000 of capital invested in the entire gas manufacture and distribution of the United Kingdom, and that of this vast sum nearly £12,000,000 are sunk in the works of London alone. It is a momentous question, then, that is at stake just now. Will this enormous capital be reduced almost to total extinction, or will it merely suffer a trifling depreciation? If the latter, the "scare" will doubtless prove beneficial and the hurt transient. If the former, the result will be little short of a national misfortune.

At a time like the present the Parliamentary privileges and restrictions of the gas companies are worth recounting. They may lay their pipes in any public street within the area defined by the Act, sell coke, tar, and other refuse, sell and rent out meters, and contract with public bodies for the supply of gas. But they must not charge more than the maximum prices fixed by the Act, they must supply all houses within a certain distance, they must supply public lamps at reduced rates, they must not pay a dividend exceeding 10 per cent. on old and generally 7 per cent. on new capital, and any excess of profit cannot be carried over but must be applied in lowering the price of gas. When new capital is issued now, the shares must be put up to auction and cannot be distributed amongst existing shareholders as formerly. The illuminating power is regulated by the Act as also the mode of testing it. In spite of these limitations to their prosperity the gas companies have grown fat, and perhaps also a little lazy and self-satisfied.

But if they have been inclined to slumber of late their awakening has been a rude one, and it has now become clear to them that, in any case, their lot in future will not be so smooth as it has been. The electric light is a declared rival, and if it does not entirely supersede gas, it will at least enter into a formidable competition with the latter, and gas producers will have to bestir themselves to better the quality of their light so as to make it cope successfully with electricity. It has been given out that if all the street lighting in the metropolis were done by the electric light, the loss of revenue thereby to the gas companies would be but a slight percentage of the gross revenue; but if the electric light invades the streets it will not stop there; it will find its way into some of the shops and warehouses too. There is plenty of hope for the gas companies however, if the much needed distributor for the electric current is not forthcoming. They will still have a wide field of domestic illumination to work upon, and if they are compelled to resign the lighting of large stores and factories to the electric light, they may still contribute to this indirectly, by supplying gas to the gas engines which are likely to be in great demand as motors for driving the dynamo-electric machines. For cooking and heating purposes, gas stoves are coming more and more into favour, and there is also something in the likelihood that the introduction of the electric light will raise the general standard of illumination and call for a brighter gaslight in shops and homes. Oil has not entirely superseded candles, nor has gas entirely superseded oil, but each of these has been restricted in its sphere of application by the successive introduction of the other. Even so it is probable that the introduction of electricity will limit the sphere of gas lighting but will not totally eradicate it.

But in the event of Mr. Edison's solution of the problem of electric lighting being as sweeping as he claims it to be, we are confronted with another set of probabilities. A powerful attempt would be made by the gas companies to buy up the new system of lighting. Already we hear that a deputation of their leading men has been convened to wait upon the Board of Trade as soon as the Board can receive them (which will not be until the middle of November) with a view to obtaining Parliamentary powers to supply the electric light. The present powers of the com-

* We hope to give a clear account of Edison's Electric Light in our next issue.

panies limit them to the production and distribution of gas only, in the manner we have seen, and before they can apply any of their capital to the production of electricity they must obtain such powers as only the Imperial Parliament can grant. Troublesome as this course is, and expensive, for fresh capital would have to be expended to install the new light, while the old expended capital would still be a dead loss, it would be the only one left for the gas companies in such a case. It is a course, nevertheless, which would be bitterly opposed, not only by a large section of the public, jealous of the gas monopoly, and irritated against it, but also by private companies already formed to work the light, and, above all, by city corporations and town councils. There is a growing feeling that the water and light supply of towns should be in the hands of the corporation appointed by the whole body of ratepayers. Several large towns, including Manchester, manage both their water and light supply, and it must now be a matter of regret to London gas companies that they have not sold their rights to the City of London ere this. It is a significant fact that the Metropolitan Board of Works have arranged for the lighting of the Victoria Embankment by Jablochkoff's electric candle. Reliable city corporations could supply the electric light to their own citizens at a much cheaper rate than private gas companies paying a dividend on unproductive capital, and they are not likely to lose so good an opportunity as now offers to acquire the privilege.

RAPIEFF'S ELECTRIC LIGHT.

RAPIEFF'S system of electric lighting, introduced into England by Mr. E. J. Reed, C.B., and under the management of Mr. Applegarth, is deservedly one of the foremost now in vogue. A recent trial at M. Rapieff's works, Middle Street, Smithfield, fully demonstrated its excellent qualities to all who saw it; and it has been introduced into the *Times* publishing office on an extensive scale, there being now some eighteen lights employed at that place to light the printing and composing rooms. One great advantage in the light is that it can be sustained for a whole night, if necessary, without change of carbons or any attendance, and the intensity keeps always the same, however much the carbons are consumed, or "burn low." In Jablochkoff's electric candles, the strength of the current increases as the candle burns down, because it flows up one carbon and down the other through the whole length of the candle; but in Rapieff's lamp, the current passes always through the same length of carbons.

Fig. 1 illustrates the regulator form of Rapieff's lamp. The electric wick consists not of two but of four carbons *a*, *a'*, and *b*, *b'*. These are opposed to each other in pairs as shown; the upper pair *a*, *a'*, is fed by the positive current, the lower *b*, *b'*, is fed by the negative current. As placed in the lamp, these four carbons form the figure X, with this difference, that the lower pair is set in a plane

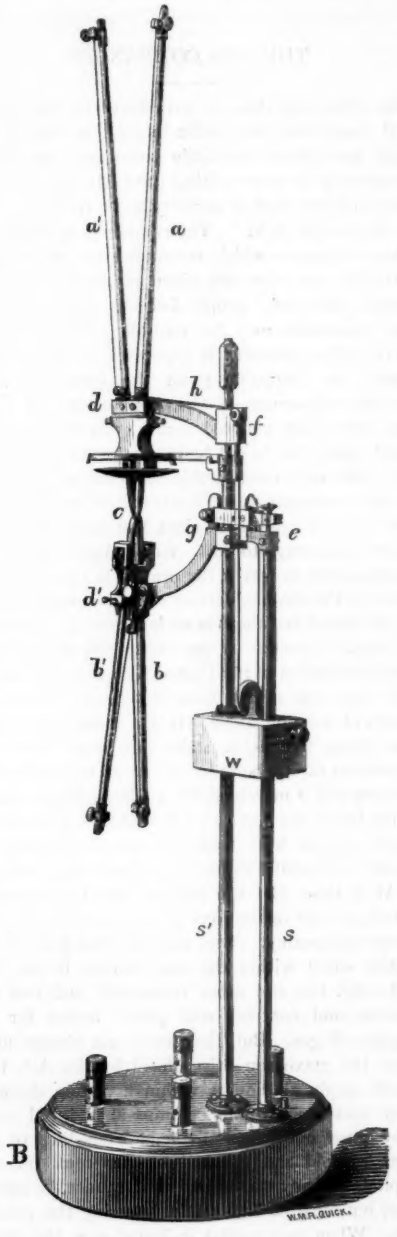


FIG. 1.

perpendicular to the upper pair. Between their points is formed the luminous arc. As the points

consume away, the carbons are made slowly to approach each other, so that the arc is always of the same width, and keeps its fixed position in space. To effect this, the carbons are directed

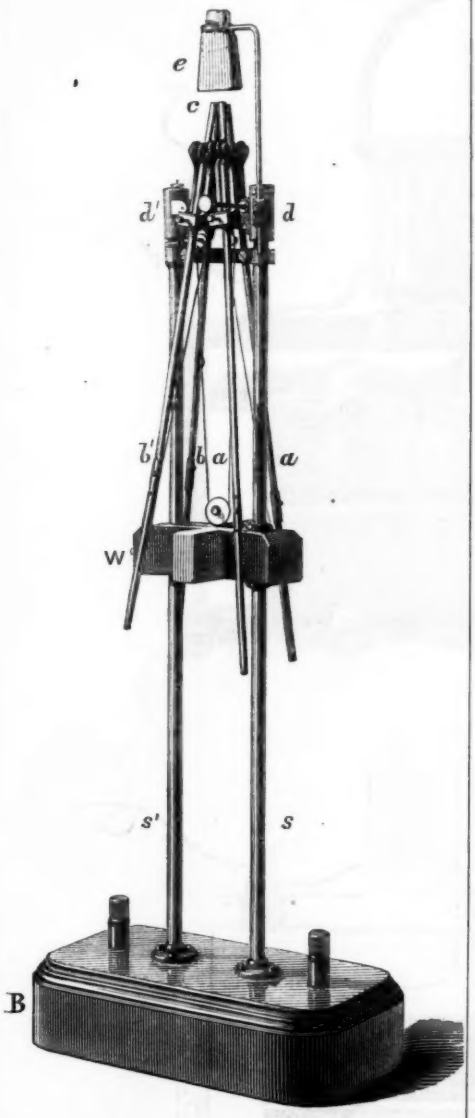


FIG. 2.

together over small pulleys at *d*. The directing force is supplied by a lead weight or counterpoise W, of about three pounds, which slides down the brass stems *s*, *s'*. By means of an iron pulley on the weight W, and other small guiding pulleys fixed at suitable places on the lamp, the weight is supported by two silk or asbestos cords from the outer ends of the carbon sticks as shown. Each cord connects the outer ends of the two opposite carbons, in such a way that the pulley hangs from the light. In this way the descent of the weight draws the four carbons equally together as they are wasted away. A curved reflector of silvered brass or porcelain is fixed a little above the inner ends of the upper carbons. By means of screws at *f* and *f'*, the width of the arc is adjusted, and by similar screws the angle at which the lower points face the upper ones can be varied, so as to direct the arc to one side or the other. The lamp is supported by two brass stems *s*, *s'*, from a wooden base B, which carries four terminals for connecting the wires conveying the current. The base is hollow, and contains an electro-magnetic apparatus for starting the light. At first the carbon points are in contact; but when the current is put on, it passes through a dual electro-magnet in the base, the armature of which is attracted upwards, and pushes a rod up the hollow stem *s'*. This rod allows the lower carbons to drop away from the upper to the full width of the arc, as previously adjusted. A detailed description and illustration of this electro-magnet is given in the *Telegraphic Journal* for September 1. The positive and negative currents pass to their respective upper and lower carbons by means of the stems *s*, *s'*, and the curved brackets. With carbons 20 in. long, and 5 millimetres in diameter, the light is maintained for seven or eight hours, and with those 6 millimetres thick it is kept up for nine or ten hours. The light is equivalent to from 100 to 120 gas flames, or say about 1,000 candles. The smallest form of the lamp made gives a light estimated at five gas flames. M. Rapieff is now constructing a form of lamp made to burn upside down, in order that it may be fixed on the ceiling of rooms. Mica plates are sometimes used to screen off the heat from the cords when they are of silk. The resistance of the arc is only two or three ohms.

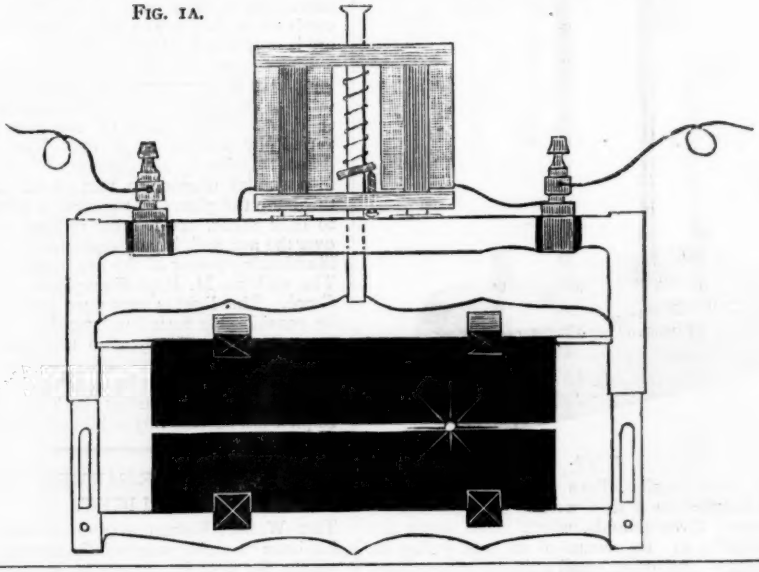
Fig. 2 represents the moderator form of Rapieff's lamp. In it the carbons are simply inclined to each other at an angle which can be regulated by screws at *d*, *d'*. The width of the arc can also be varied by screws at *d*, *d'*. The carbons are drawn together by the descent of a counterpoise W, in a similar manner to that above described. In this lamp the planes of the carbon pairs are parallel to each other. A cylinder of lime *e* is supported over the arc, and, becoming luminous, increases the illuminating power of the arc by about 40 per cent. The carbons M. Rapieff employs are made by M. Carré. The light is very pure and white, and can be considerably varied in intensity by the adjusting screws. Gramme's dynamo machines are at present used in the *Times* office, but we believe that M. Rapieff has patented one of his own. There are six lamps in each circuit at the *Times* office; but M. Rapieff has successfully exhibited as many as ten.

THE WALLACE-FARMER ELECTRIC LIGHT.

THE Wallace-Farmer system of electric lighting has been brought prominently forward in England within the last few weeks by its connection with the reputed invention of Mr. Edison. The Wallace-

FIG. 1.

FIG. 1A.



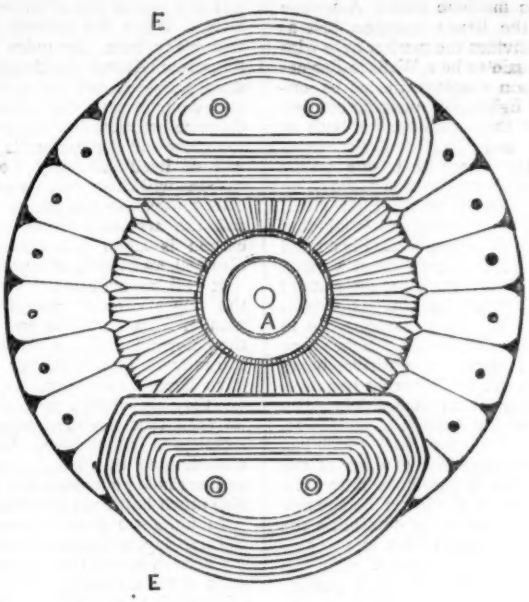


FIG. 3.

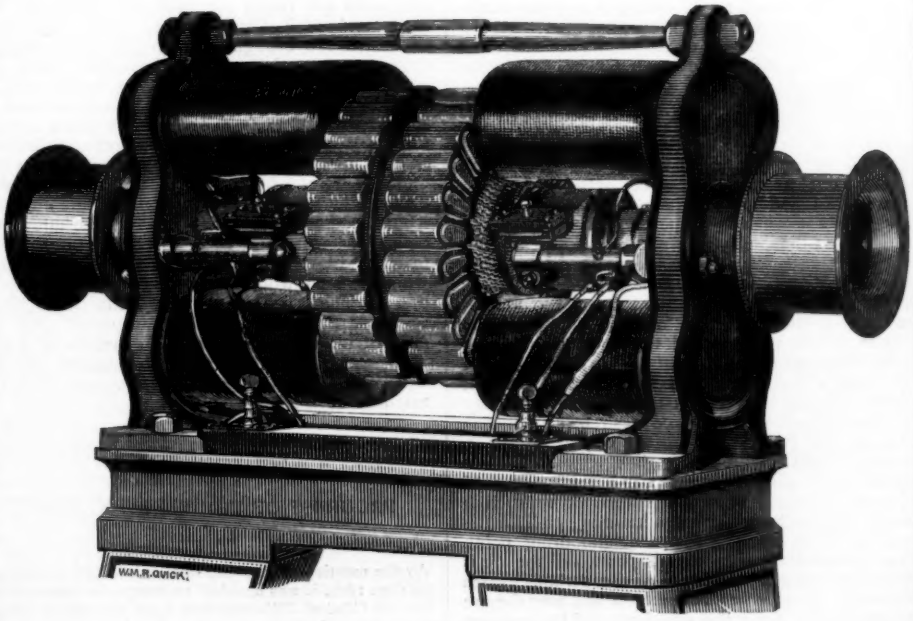


FIG. 2.

Farmer dynamo-electric machine shares American patronage along with the Brush machine, just as the Siemens' machine divides the market here with the Gramme; and it is said to be a Wallace-Farmer machine that Mr. Edison employs in his experiments. The system of lighting in question consists of a special lamp and this machine, for both of which Messrs. Ladd and Co., of Beak Street, are sole British agents. More than one public exhibition of the light has been given in London by these gentlemen at their steam works, Shoreditch, and we believe that it is likely to be widely adopted by reason of its simplicity and cheapness. Figs. 1 and 1A, illustrates the lamp itself. It consists of a metal frame of brass, fitted with terminals for the current as shown. This frame carries the two gas carbons forming the electric wick. These carbons are in the form of short rods or slabs about 9 inches long by 3 inches broad, the upper, or positive, being about half an inch thick, and the lower, or negative, being only about quarter of an inch thick. The lower carbon is fixed to the bottom of the frame, and the upper is carried by a cross-piece, which can slide up or down in grooves in the sides of the frame. The upper carbon is therefore moveable, and can be drawn apart from the lower one to any adjusted distance, say $\frac{1}{8}$ in., so as to determine the luminous arc. When the lamp is not in use, this upper carbon is let down into contact with the lower one, and rests upon it; but the act of putting on the current raises the upper carbon $\frac{1}{8}$ in. and establishes the light. This is effected by means of an ingenious electro-magnetic contrivance, supported above the frame as shown. The vertical stem, which is fixed to the sliding cross-piece carrying the upper carbon, passes between the two bobbins of a double-poled electro-magnet shown in section. This magnet is inverted, the free poles and moveable armature being undermost. This armature (which is perforated to allow the stem to pass through it) carries a screw, which, when the armature is attracted upwards by the current, tilts a small metal ring, or washer, hung from a spiral spring, and enclosing the stem into an inclined position, so that it jams the stem tight and holds it fast in the manner delineated. The first act of the current then, after it is put on, is to attract the armature until it jams the stem attached to the upper carbon, and the armature being further attracted into contact with the poles of the electro-magnet, it lifts the stem with it, and raises the upper carbon plate until its lower edge is about $\frac{1}{8}$ in. above the upper edge of the lower plate. The arc then either establishes itself at the points of least resistance between the two carbons, or it may be established at any place desired, say at one corner, by inserting a metal conductor for a moment between the two carbon edges. The arc once started continues to subsist at that point until the consumption of carbon widens it to such a degree that a shorter and less resisting path for the current is to be found at a neighbouring point. The current then chooses this point, and the arc is established there, until waste of the carbons causes it to shift its place as before. In this way the arc travels slowly along the whole edge of the carbons, and when it reaches the other end, it turns and comes back again. For 100 hours the light can in this way be maintained without change of carbons, and at a cost of about 1d. per hour per lamp for the latter. When the current is cut off, the armature falls away from the poles of the electro-magnet, the screw releases the clamping washer, the vertical stem is freed, and the upper carbon drops down into contact with the lower carbon. When the distance between the carbons becomes at any time too great and the current is enfeebled, the armature will of itself fall away from the poles, and the carbons will close up to each other in this manner. This causes the current to regain its full strength, and the armature being again raised, the upper carbon is again withdrawn from the lower and clamped, and the light thus restored automatically.

It will be understood from our description that the upper carbon cannot be withdrawn in this manner from the lower one to a distance over $\frac{1}{8}$ in., the determined range through which the armature can move. Thus however much the carbons may have been wasted away, at the re-setting of the arc they are always withdrawn $\frac{1}{8}$ in. apart. It will be seen that the mechanism of this lamp is very simple and inexpensive. Messrs. Ladd and Co. are also making this lamp in an improved form, the carbons being narrower and deeper, the frame being also much lighter in construction.

In fig. 2 we give a front view of the Wallace-Farmer duplex dynamo-electric machine, and in fig. 3 a section across the electro-magnets, showing the coils of the armature end-wise, and the connections of the coils to the axle on which the metal collecting brushes rub. E, E, are the fixed inducing electro-magnets of opposite polarity, and *c*, *c*, *c*, are the rotating coils of the armature. There are twenty-five coils set round the armature, and each coil is wound with four separate wires, the ends of which are brought up to the axial commutator, so that there are a hundred makes and breaks, or current interruptions, in one revolution of the armature. The machine can be worked up to 800 revolutions a minute, giving 8,000 current impulses. To drive it the power required is about 1 horse-power for every 100 revolutions per minute. Thus 8 horse-power would be required to drive it at a speed of 800 revolutions, and this rate would feed eight lamps in circuit, the allowance being one lamp for each 100 revolutions. The machine illustrated is made in two distinct parts, which can be worked separately or joined up as one machine. It may be used either for lighting or electrotyping, and other purposes; but for electrotyping is slightly varied in matters of detail. The armature coils, the electro-magnets, and the work to be done, are all in one circuit when the machine works.

PROGRESS OF THE ELECTRIC LIGHT.

AT the meeting of the Metropolitan Board of Works on Oct. 18th, it was decided to accept the offer of the Société Général d'Electricité to light the whole length of the Victoria Embankment, and, subsequently, if considered desirable, the Waterloo Bridge, with Jablochkoff's electric candle. These places are the only thoroughfares in the custody of the Board, and their

enterprise is very commendable. The cost of establishing the light on the embankment is estimated at £600.

A football match by electric light was played at the Bramall-lane Grounds on the night of Oct. 14. Upwards of 30,000 people gathered to see the match, which commenced at 7'30 p.m. The light was thrown on the ground from four lamps, each thirty feet from the ground, and the rays lighted up nearly the whole of the grounds, so that the players could be seen almost as clearly as at noonday. The brilliance of the naked light sometimes dazed the players and caused strange blunders, but the match was highly successful. Behind each goal was placed a portable engine, which drove two dynamo machines, one for each light. The illuminating power was equal, it is said, to 8,000 standard candles, and the cost per hour for each light was 3¼d.

The electric light has been introduced into Pullar's Dye Works, Perth, with great advantage over gas, as it shows the most delicate colours in their true tints.

It is also about to be introduced into the *New York Times* composing-room. The present cost of gas there is £100 per month, whereas the electric light is estimated to cost only £20 per month, after the first outlay for installation, which will amount to £200.

The Directors of the Crystal Palace invite offers for lighting the Concert Hall and one other department of the Palace by electricity.

The *Dundee Advertiser* publishes a rumour to the effect that a London mechanic has invented a means of generating electricity by which a house can be lit electrically for a first outlay of £20, and afterwards maintained in light for a few pence per month.

The *Times*, since October 12, has been printed off by help of Rapieff's electric light, no change of carbons being required.

EDISON'S ELECTRIC LIGHT.—We hear that a year ago Mr. Edison discovered a new material which can be rendered luminous by the passage of the current through it, without wasting away. With this material the circuit is perfectly continuous and steady. Edison's system of lighting probably unites this electric wick with a new mode of subdividing the current. Every effort is being made to secure the patents in almost all civilized countries, and as soon as that is done the process will be exhibited in this country. Numerous applications for the sale of the patents or for licenses under them have been already received by Mr. Adams, Edison's London agent. This gentleman has publicly denied the prevalent rumours that "the whole thing is a hoax." A company has already been formed to introduce the light in America; and the English and foreign patents have been applied for.

A CONTINUOUS WICK for the electric light is not a novelty; and Mr. Edison will only be able to secure a patent for it because of the nature of the substance employed. As far back as 1845 an English patent in the name of King was taken out for metal or carbon rods heated to whiteness by the passing current, and in 1873, M. Lodighin revived the plan in the case of carbon, by enclosing it in a vacuum. Three of Lodighin's lights, improved by Messrs. Roun and Bouligine, have been used on the premises of M. Florent, a linen merchant of St. Petersburg, for the last three years. The light is found to be bright and economical; but its special advantage lies in the fact that it has not the deteriorating effect on the white linen which gas has.

WRITING to the *Daily News* of Oct. 18, Mr. J. Berger Spence, 31, Lombard-street, claims the honour, of first successfully subdividing the electric light, for Mr. Richard Werderman, who some weeks ago had ten lights from one circuit, and in a few weeks will have some hundreds. A trial of this light, which admits of over ten lights in one circuit, will take place in a few days.

THE OTTO GAS ENGINE.—Messrs. Crossley Brothers have orders on hand for Otto gas engines, designed for electric lighting purposes, enough to keep them busy for months to come.

SIEMENS' REGULATOR.—The following account of Siemens' new regulator for keeping the resistance in circuit of an electric light constant, is taken from Dr. C. W. Siemens' letter to the *Times* of October 12th:—"In passing an electric circuit from a main conductor into several or any number of branches, the current divides itself between those branches, according to the well-known law of Ohm, in the exact inverse ratio of the electrical resistance presented by each branch. A current may thus be divided, for instance, into ten separate currents of precisely equal force, if each branch is made to consist of a wire of the same length and conductivity; but if one of these wires was again to be slit into ten wires, presenting in the aggregate the same conductivity, each of these wires would only convey 100th part of the total current. In the same way one of the minor wires might again be subdivided into branches each of which would convey an amount of electric current which would be accurately expressed by the relative resistance of the branch in question, divided by the total resistance of all the branches put together. It would thus seem that nothing could be more easy than to divide a powerful electric current among as many branches of varying relative importance as might be desired; but in the case of electric lighting a difficulty arises in consequence of the varying resistance of each electric light or candle, due to the necessarily somewhat varying distance of the carbon points from each other, upon which the length of the luminous arc depends. In order to work a number of lights upon different branches of the same current, it is necessary to furnish each branch with a regulator so contrived that an increase of current corresponding to too near an approach of the carbon points will produce automatically an increased resistance in that branch circuit, whereas an accidental increase in the distance between the carbon points of any lamp will cause the regulator to reduce the extraneous resistance of the circuit to a *minimum*. Such a mode of regulating currents was present in my mind when, in addressing the Iron and Steel Institute in March, 1877, I ventured to express my conviction that natural forces, such as represented by large waterfalls, could be utilized for the production of motive power and electric light, in towns at a distance even of 30 miles from such source, by means of a large electric conductor. This suggestion gave rise to a good deal of discussion and criticism, especially in the United States; but I replied to some of these criticisms in delivering one of the Science Lectures at Glasgow, in March last, having already referred to the matter in a discussion that was held before the Institution of Civil Engineers on the 29th of January last. Having in the meantime perfected the regulator, I showed it in operation at the *soirée* of the Royal Society on the 19th of June, and have only been waiting to get experimental *data* complete, in order to bring the whole subject before one of the scientific bodies. The arrangement may be said to consist simply of a thin strip of copper or silver, say 6 inches long and half an inch broad, stretched horizontally between two supports with a weight or spring exerting a certain pressure in the middle. The branch current to be regulated is passed through this strip of metal, which is thereby heated to a certain moderate extent, depending upon the amount of current passing, and upon the rate of radiation of the heat produced in the strip to surrounding objects. Suppose that when the normal condition of things obtains, the strip of metal is maintained at the temperature of say, 100 deg. Fahrenheit, and suppose that by an accidental approach of the

carbons of a lamp the resistance of the circuit is suddenly decreased, an almost instantaneous increase of temperature of the thin strip will ensue, which will cause it to elongate slightly, and allow the weight resting in the middle to descend, which in its turn causes an increase in the resistance of a small rheostat, through which the branch current in question has to flow.

THE Government authorities are trying the adaptability of the electric light for the illumination of large workshops by some experiments at the Royal Arsenal, Woolwich. A new carpenters' shop has recently been erected at the Royal Laboratory Yard, and, pending the provision of gas fittings, a single electric lamp has been hung from the roof, and by its light, men have been making shot-boxes for a week past. It is found that the lamp furnishes a good light to work by for fifty feet in every direction, and that for workshops where the roof is high and the space unobstructed the electric light is suitable and pleasant. The cost of the one lamp has been 8d. per hour, and it answers the same purpose as forty or fifty gas jets, but the steam power for generating the electricity is supplied without charge from the shafting in the main factory adjacent, and nothing is calculated for wear and tear of apparatus. The light, though always brilliant, is somewhat intermittent, consequent upon the ever-varying pressure upon the machinery, which drives more than five hundred lathes, and the small limit between the minimum and maximum number of revolutions required for the electric light is thought to render the employment of standing machinery in most cases unsuitable. The apparatus has been tried in the Shell Factory of the Royal Arsenal, and the light was popular with the workmen, but probably from inexperience, the result was not quite successful. It is proposed to place a light in the outer yard of the laboratory, in front of the model room; and it is also contemplated to light the main factory in the same manner, but the network of machinery and bands and the low pitch of the roof are unfavourable to the experiment.

THE ELECTRIC LIGHT IN WAREROOMS.—On the evenings of October 9 and 10, Messrs. Wells and Co. gave special exhibitions of the Jablochkoff electric light now fitted up within their commodious and elegant iron and marble warehouse at High Street, Shoreditch. The light was supplied to them by the *Société Généralé d'Electricité* of Paris, the owners of M. Jablochkoff's patents, and Messrs. Wells will be glad to furnish parties applying to them with information regarding the cost of installing and using the light, and also to undertake the supply of it; but they request an early application as they have now a great many orders on hand for it. The new wareroom of Messrs. Wells, full as it is with handsome particoloured marble and polished metal fireplaces, bronzes, statuettes, and chimney ornaments, is well chosen for a display of the electric light. There are four of Jablochkoff's large opal lamps, 18 inches in diameter, fitted up in the warehouse being some 60 feet long by 35 feet wide, with three galleries and a total height of some 60 or 70 feet. Two of the lamps are supported over the middle of the basement floor, and the other two project on brackets from the upper galleries at the end of the room. The motive power (about 6 horse-power) is supplied by the steam engine on the premises. The light is generated by two Gramme machines of the new alternating current type, revolving at the rate of 1,000 and 1,100 times respectively per minute, and supplying alternating currents at the rate of about 16,000 per minute. By these alternating currents the equal consumption of the parallel carbon rods forming the carbon is ensured. The wicks are of gas carbon with kaolin between. Each lamp is provided with holders for four candles, but only one is used at one time. Each candle burns 1½ hours. When nearly consumed a switch moved by hand, or automatically by an electro-magnet, turns the current to another candle, without disturbing the general effect of the light. The light radiating from the whole surface of the globes is soft and agreeable, while the shadows are scarcely visible. This tempering of the intensity of the light by opal globes, however, cuts off from 30 to 50 per cent. of the total supply. Each lamp is estimated to yield a light equal to 100 gas jets, but it is probably equivalent to many more because of the whiteness of the light as compared to gaslight.

At the meeting of the Commercial Gas Company on October 4th, reports on the electric light in Paris were submitted by the engineer of the Company, Mr. Robert Jones, and by Mr. John T. Sprague, Member of the Society of Telegraphic Engineers. The most noteworthy points in these reports are the following:—According to Mr. R. Jones, the photometric value of a single Jablochkoff or a Lontin light is 600 sperm candles; but, unless a reflector and lens be used, he thinks the power of the light to penetrate space seems to fall off rapidly. The opaline shades reduce their value by 60 per cent. None of the lights were placed at over 200 yards from the machine supplying them. In Mr. Jones' opinion, the electric light might get a field in long, wide streets, and in large halls free from partitions and galleries, where the current expenses of attendance, &c., in a separate establishment would not bear too high a proportion to the amount of light required. But as the main bulk of gas consumers in the metropolis would have but a five-light gas-meter, and use, perhaps, seven lights in a ten-roomed house, fitted as a shop, these people (says Mr. Jones), would have a vested interest in the present mode of lighting, as the gas fittings will have cost them several pounds; moreover, many of their lights are only occasionally used, and others are small lights in passages, closets, &c., where at the very smallest expense, perhaps not 2s. 6d. a year, the place is adequately lighted for their purpose. Any offer of the electric light to such people would, Mr. Jones thinks, be rejected.

Mr. Sprague classifies the electric lights of Paris into two systems, based upon the purpose for which they are used—Lontin's and Jablochkoff's. At the Gare de l'Ouest two of Lontin's lamps are placed over the principal entrance, and five lamps are ranged along the middle of the principal hall, where they replace 34 gas burners. The goods department is lighted by six naked wicks, worked by one machine and steam-engine. The result is very effective, as the men, loading and unloading, can easily see the addresses on the packages, and the work is done readily and safely. In the court-yard of the "Hotel du Louvre," which is roofed in, there are—one lamp in the entrance, two lamps on one side of the courtyard, and six globes distributed over the staircase, forming the other side of the yard. These lights here replace 14 two-light gas lamps and 24 single globes upon the staircase. The shopkeepers do not reduce the gas-lights necessary for illuminating their shops, as some people have expected; and Mr. Sprague estimates that the fluctuations of the light in the Avenue de l'Opéra vary to the extent of one-fourth of the maximum power. In the Hippodrome there are 20 globes on the boundary line of the arena and the audience; between these there are also columns carrying three gas-globes turned towards the seats; above, there are 16 naked lights with reflectors, throwing the light on the middle of the arena. There are thus 36 lights in full action, and in addition there are four naked lights suspended from the roof, and employed during the trapeze performances. "But, with all these powerful lights," says Mr. Sprague, "the result was

poor compared with the rich radiance we are accustomed to in theatres." Mr. Sprague concludes that the electric-light has a place of its own to fill, but that there is little probability of its being adapted to domestic purposes; and he feels no hesitation in expressing the conviction, after full examination of the subject, that the gas companies of London have nothing whatever tofear, and that whatever may happen to gas shares, owing to market operations, gas dividends will not suffer the reduction of a shilling by any competition with the electric light.

THE ELECTRIC LIGHT IN CHANCERY. — At the Supreme Court of Judicature, on October 15, Mr. Henry Wilde applied for an interim injunction to restrain Messrs. Wells and Co., marble and iron merchants, Shoreditch, from exhibiting Jablochkoff's electric light. Mr. Wilde is the inventor of a dynamo-electric machine, now in use on some of Her Majesty's ships, and possesses patents for it taken out in 1863 and 1865. These patents have been extended to the year 1884. During the past summer, he (the plaintiff), while in Paris, found that the Société Générale were using a machine for lighting several parts of the city with the Jablochkoff candle, which was a plagiarism of his invention. The Société informed him that they intended to introduce the light into England, and Mr. Wilde replied that they must first get his sanction, and negotiations were begun between them for this purpose. In the meantime, however, Messrs. Wells and Co. publicly exhibited the light in question, and although the plaintiff had sent final terms to the Société Générale, who work the light, he had not received any reply. Mr. Justice Hawkins, who presided as Vacation Judge, granted an interim injunction, which was rescinded the following week.

AT a recent meeting of the City Commission of Sewers it was decided to light the Holborn Viaduct and the space in front of the Mansion House by electricity.

THE Exeter Town Council, who were about to purchase the Gas Works, have refrained at present in consequence of the success of the electric light.

A PROPOSAL by Mr. Yeates to light electrically the whole Harbour of Cork for £5,000, by four lamps at a cost of 4d. per hour for each, has caused a panic in Dublin gas shares.

BILLINGSGATE Fish Market will be lit electrically by Jablochkoff's candles on Nov. 5, a Robey's fixed engine being used.

COST OF THE ELECTRIC LIGHT.

THE following extract on this somewhat obscure subject is taken from the *Standard* of Oct. 10:—

"Amid all the excitement which prevails on the subject of the electric light, it is remarkable how little is known with regard to the cost of this delightful and effective mode of illumination. Even so scientific a man as Mr. E. J. Reed, writing on this subject to a London newspaper, is compelled to say—'I am unable, although having much to do with the development of M. Rapieff's improvement, to give just at present the exact cost of lighting under his system.' Mr. Reed, however, goes far enough to say that the electric light, as introduced by M. Rapieff, is made cheaper than heretofore, and is 'certainly very much below the cost of gas for equal amounts of light.' Some results are quoted by Mr. Reed from M. Hippolyte Fontaine as having been obtained by the Gramme machine at a cloth factory at Rouen; but the comparison is made with gas at so high a price as to show that London gas would be cheaper than the electric light. It may be as well, therefore, to endeavour to carry the question a step further. Data whereby to judge of the relative cost of gas and the electric light have already appeared in our columns. Thus it is found that the electric light exhibited the other evening over the shop front of the London Stereoscopic Company in Regent-street was obtained from a Siemens' dynamo-electric machine, driven by an Otto silent gas engine, consuming gas at the cost of one penny per horse power per hour. The engine was of eight-horse power, but was only worked up to the power of five horses. The light produced by this rate of working was said to cost, inclusive of all charges, sevenpence per hour, and the amount of light produced was stated to be equal to that of 4,000 sperm candles. On these data it should be stated that a standard gas burner giving the light of 16 sperm candles consumes gas at the rate of five cubic feet per hour. Two hundred and fifty gas burners would be requisite in order to get the light of 4,000 candles, and the consumption of gas for these burners would be 1,250 cubic feet per hour. The lowest price charged for gas in London is 3s. per thousand feet, at which rate the 1,250 feet just mentioned would cost 3s. 9d. But the electric light equivalent to 4,000 candles only costs 7d. At this rate gas is at least six times dearer than the electric light. So far as concerns the quantity of gas used for working the engine, there is every reason to believe that the statement is correct, it having been proved, on good authority, that the Otto engine requires only twenty-one cubic feet of gas per indicated horse-power per hour. Supposing the gas to cost 3s. 6d. per thousand feet, as it probably would do in Regent-street, a penny would purchase nearly twenty-four cubic feet. On the fivepence for the five horse power there is an addition of twopence to pay for carbons and waste, and perhaps something more should be added for interest, wear and tear, &c. But there is a wide margin for anything of this kind. A question may be raised as to the amount of lighting power. From the 4,000 candles we must deduct 30 per cent. for the absorption and loss of light consequent on the intervention of ground glass. This brings down the light to 2,400 candles. If we say 2,000, we then find that the electric light is, at least, three times cheaper than gas, light for light. If there be any dispute as to the actual amount of light emitted by the lamp in Regent-street, it is evident that a very large reduction may be allowed, with a balance still remaining in favour of the electric method.

"It has been said that by a novel application of naphthaline, the lighting power of gas can be enhanced fourfold with a merely nominal addition to the present cost. This of course would disturb the balance of the former calculation; and the gas companies will be wise if they bring this napthaline process to their aid, though it is pretty certain that napthaline will rise above its present extremely low price when it is found to be so powerful an adjunct. As the gas companies are the producers of the napthaline, a rise in its price may perhaps have very little effect on the main problem, seeing that the price of a residual product operates in reducing the cost of manufacturing the gas. It has been already stated in our report, that where the Stereoscopic Company have now one electric lamp they formerly had ten powerful argand burners. These would consume at least fifty cubic feet of gas per hour, the cost of which would slightly exceed twopence. At this rate the gas would cost about one-third the sum debited to the electric light. But the effective light of the latter would be 2000 candles, whereas the argand burners would only give the light of 160 candles. The enormous excess of light furnished by the electric apparatus thus shows itself, and demonstrates the necessity

for sub-division. If the Stereoscopic Company could do what they pleased with the fountain of light thus brought into existence they might illuminate the whole of their premises inside and out, and yet have something to spare. Taking an average of three hours per night for six days in the week, all the year round, the annual cost would be less than 30*l*. To obtain the light of 2000 candles from gas, at 3s. 6d. per thousand feet, would involve a charge of 100*l*. a year. If the reckoning is made on the basis of the entire amount of the electric light, which we have seen is equal to 4000 candles, the cost of an equal amount of lighting power from gas would be 200*l*. per annum."

So powerful a light as that above-mentioned was used by the Stereoscopic Company because they already possessed the machinery for producing a photographic light equal to 4,000 sperm candles, and temporarily employed it for the shop itself. This light is to be replaced, however, by a light equal to 1,200 sperm candles, at a cost of 4d. per hour, and still giving an excess of light. It will take the place of the ten Argand burners, which burned 50 cubic feet of gas per hour collectively. At 3s. 6d. per 1,000 feet, the cost of the gas would be a trifle over 2d. per hour, or half the cost of the single electric light, but the illuminating power of the latter would be about eight times greater. Supposing an opal globe to be used which reduced the light 60 per cent., that is, made it equal to 480 candles, then the electric light would still give three times the light at half the price of gas. With a ground glass globe the light would be only reduced to 840 lights, a still more favourable contrast.

Thus, if the electric light could be produced in moderate quantities, with equal economy as on the larger scale, it would be from 37 to 64 per cent. cheaper than gas at 3s. 6d. per 1,000 cubic feet, according as opal or ground glass shades were used. Without globes the electric light would be 75 per cent. cheaper than gas. With the 4,000 candle light of the Stereoscopic Company these ratios were respectively, 79 per cent. for naked lights, 71 for ground globes, and 50 for opal globes, hence we may infer that lesser electric lights are less economical than greater ones. On the larger scale we have 571 candles per hour for a penny, and, on the smaller, 300 candles for that sum. Sixteen-candle gas, at 3s. 6d. per 1,000 feet, yields the light of only 76 candles per hour for a penny. Even on the smaller scale, then, the electric light would be four times cheaper than gas, were it not for the loss of power due to the globes. Some of the percentage loss due to globes would also require to be deducted from the power of gas flames (for globes are much in vogue with gas) before a strictly just comparison can be made.

M. Hippolyte Fontaine, by taking the cost of gas at 0·25 franc per cubic metre (about 5s. 6d. per 1,000 feet) and calculating from data supplied by the Ducommun workshops at Mulhouse, shows that the electric light from a Gramme machine, quantity for quantity, costs less than gas in the ratio of 1 to 1·26 with interest and deterioration, or of 1 to 7·17 without such charges. For a spinning mill of 800 looms, at the same rate, the electric light would cost 33 per cent. less than gas, give six times the light, and abolish all danger of fire, which is an important consideration in cotton mills. In another calculation, M. Fontaine shows that the electric light from the Gramme machine costs six-and-a-half less than gas at 0·15 franc per cubic metre (about 3s. 4d. per 1,000 feet) for the same amount of light. Under favourable circumstances, where a special motor is not required, the Gramme electric light is estimated by M. Fontaine to be as much as twenty times cheaper than gas at 0·15 franc per cubic metre.

Mr. Sprague, in his recent report to the Commercial Gas Company, gives the following facts and figures as to the cost of the Jablochkoff and Lontin system of Paris. At the "Magasins du Louvre," 201 gasburners costing 90·4 francs a day, have been replaced by 16 electric arcs, costing only 63·6 francs a day, giving an economy of 30 per cent., with 3½ times the amount of light. In Paris, however, gas costs twice as much as in London, and is of poorer quality, and, in order to correct the cost to London prices, the cost would be 35 per cent. greater than London gas.

The price of the Gramme machines used with Jablochkoff's candles is at present £400 for the size working 16 candles; the fittings of each lamp cost £8, and the two conductors together 3s. 6d. per yard. The expenses of fitting up are to be added, and the prices of Paris for workmanship are lower than in London. Besides these items, an engine of 20 horse-power must be provided. The hourly cost of working is given as 8s. 8d. per machine,' or 6½d. per light. Each single light consumes one horse-power per hour. Mr. Sprague therefore puts the hourly cost per light at 8d.

In the Lontin system, the first cost is less, and the working expenses are also to some extent less. A 12 horse-power engine is employed for the lights at the Gaiety Theatre, London. The value of the electric light is given as equal to 100 Carcel lamps for Lontin's regulators, and 80 for Jablochkoff's candles. The value of the Carcel lamp is given by Mr. Sugg as 9·5 of our standard candles. This gives 950 candles for the value of the Lontin light, and 760 for Jablochkoff's, both being naked. These lights are enclosed in opal globes, which are stated to absorb one-third of their power. The best experiments I believe show that—

Plain glass absorbs	..	10	per cent of the light.			
Ground	,, ,,	..	30	,,	,,	,,
Opal	,, ,,	..	60	,,	,,	,,

These ratios would give the actual illuminating value o the electric light as 300 standard candles.

Ordinary gas, properly burned, will give at least the light of 14 candles for five feet per hour, that is to say, 1,000 feet give for one hour a light of 2,800 candles at a cost of, say, 3s. 4d. Assuming that the electric candle gives a light equal to 300 standard candles, and that its cost per hour is only 8d., the cost of the same 2,800 candles is 6s. 2½d., or nearly twice as much as gas for the same quantity of light.

THE LORENZ TELEPHONE CALL.

THE following description of this alarm, or call bell, is taken from the recently published treatise of M. Alfred Niaudet-Breguet, civil engineer, Paris, to which we have before drawn the attention of our readers :—

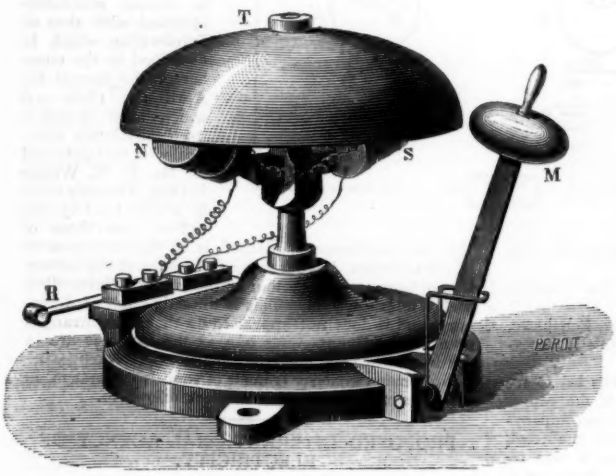
The apparatus, represented by the figure, is the transmitter of M. Lorenz. The magnet N S, is placed coincident with a diameter of the gong or bell of steel T. When, by means of the hammer M, pushed by a spring, the gong is struck in a direction across that of the magnet, the vibrations have their maximum amplitude in front of the poles, and induction currents, relatively strong are generated in the coils placed on the poles of the magnet. These currents are sent to the corresponding station, and are there received in the Bell telephone slightly modified—the bobbins being more powerful than in ordinary telephones, and a resonator being also added to them. This resonator is a long cone

of white iron, truncated at its top, the small end being inserted close to the telephone diaphragm.

In order that the resonator should give the best results it should be tuned over the bell of the transmitter and regulated in length accordingly.

This call gives out sounds easily heard throughout a workshop. We have proved that, with a little attention, it can be heard at a distance of 10 or 12 metres in an open concert hall, and at 5 or 6 metres when the hall is filled with the public. It must, therefore, be admitted that the Lorenz call yields an alarm sufficient for a great number of cases.

The resonator telephones can otherwise serve for conversation in a similar manner to the ordinary ones. It should be stated that the bell transmitter has a commutator (not well shewn in the figure) which puts the apparatus habitually on short circuit. When, therefore, one wishes to call, it is necessary with one hand to press upon the commutator in order to put the apparatus in circuit, and with the other hand to strike the bell with the hammer.



THE LORENZ TELEPHONE CALL.

THE WATCH TELEPHONE.

THIS form of telephone, as will be seen from the illustration, takes its name from its likeness to one of the old-fashioned "turnip" watches. The figure shows its full size, and it is the smallest kind of Bell telephone yet made. The magnet is bent into a circular form, and the coil is seated upon one of its poles, the planes of the magnet, coil, and diaphragm being all parallel to each other. The articulation is as distinct as with the larger telephones. This convenient form of telephone, which can easily be carried in the pocket, is a design of M. Alfred Niaudet-Breguet, Paris, to whom we are indebted for the illustration.

THE WATCH TELEPHONE.

Correspondence.

To the Editor of THE TELEGRAPHIC JOURNAL.

SIR,—In reply to Mr. Fanshawe's letter in your impression of 1st ult. on "some errors and misstatements" in my paper on "A New System of Duplex Telegraphy," I beg to make the following remarks.

Owing to an error in working out the formula on page 87 (*Telegraphic Journal*, April 15th, 1877), the values of A and B were wrongly given, on page 86, as 39 and 1461, instead of 40·78 and 1459·22. Taking these figures, it will be seen that

$$\frac{A}{B} = \frac{33{\cdot}33}{1192{\cdot}83} = \frac{40{\cdot}78}{1459{\cdot}22}$$

The error here is therefore only apparent.

I do not see how Mr. Fanshawe gets 5·1 instead of 8·3 cells as the strength of the current that E sends to the line on depressing K. I have carefully gone over the calculations again, taking the corrected values of A and B, and find that 8·275 cells is the exact strength. Will Mr. Fanshawe kindly look into this again and tell us how he arrives at his figures.

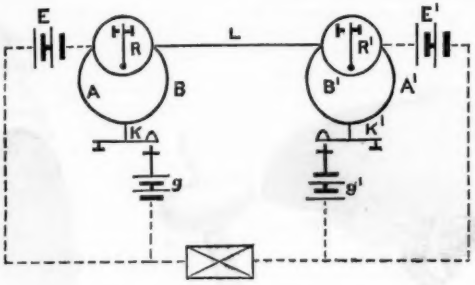
Mr. Fanshawe thinks me wrong in saying that the strength of the signal is the difference between (to be exact) 57·14 and 34·48 cells; but if he will read the passage again carefully he will see that I am quite

correct. When the system is at rest the current in R' is 57·14 cells, and when K is depressed it falls to 34·48 cells. In the one case the tongue of R' is held away from the contact stop by a force of 57·14 cells, and in the other by a force of only 34·48 cells. Now, as the tongue is so adjusted that its tendency towards the contact stop is just counterbalanced by the opposing force of 57·14 cells, it follows that 34·48 cells are entirely unable to restrain it, and consequently it falls over with a force which is the difference of the two, or 22·52 cells.

Taking Mr. Fanshawe's propositions categorically—

(1) When both keys are at rest, the current through each relay is the $\frac{1}{2}\frac{5}{1}\frac{0}{0}$ths of 80 cells, or 57·14.

(2) When one key is depressed, the current through the relay of that station is still 57·14, practically, as both calculation and experiment will show. Were it otherwise, as Mr. Fanshawe makes out, duplex working would be impossible. The current through the distant relay is 34·48 cells.



(3) When both keys are depressed, the current through each relay is 34·48 cells nearly.

The error on page 87, pointed out by Mr. Fanshawe, is so obvious a misprint that I did not think it necessary to correct it at the time.

I may mention that some months ago I was led to try the effect of substituting for earth at K and K' the copper and zinc poles of two batteries as shown in the accompanying figure. On depressing the key K, R was unaffected, while the current in the line and distant relay R' was reduced to a greater extent than when K was simply put to earth. In other words, the substitution of a suitable battery pole for earth had the effect of increasing the strength of the duplex signals. A like effect was produced on depressing K', R' was absolutely quiescent, while R was closed with increased force. I hope soon to try this modification on an actual line, and will be happy to communicate the results. I am now engaged in determining the proper proportions that should exist between the batteries E and g, and E' and g'.

In conclusion, I would be glad to know if Mr. Fanshawe has tried my system in India, and with what results. If he would kindly communicate them through your esteemed Journal he would greatly oblige me.

Yours faithfully,

J. J. FAHIE.

Persia, 25th September, 1878.

[We have not examined the improved duplex system very carefully, but we are inclined to think that no advantage is gained by thus dividing the batteries, that is to say, if g and g' were added to E and E', instead of being put in the earth circuit, the signals would be almost, if not exactly as strong. We shall be glad, however, to hear further on the subject.—ED. TEL. JOUR.]

F.—We have done as you wished, and the reply we have received is:—"No new duplex system is wanted." Although we regret that you should be disappointed, at the same time we must point out that such a reply seems to us to be inevitable. It is hardly likely that a new system, unless it is very much superior to the one at present in use, would be employed either as an accessory to, or as a substitute for, the existing system; to make such a change would either necessitate the reconstruction of the existing apparatus or would still further increase the variety of instruments in use, which variety is at present, to say the least, quite as great as is convenient. With reference to the advantages which you claim for your system, we must point out that, as far as we are aware, the only portion of Stearns' apparatus that is employed in the system you refer to, is the condenser; the differential method, which requires only one rheostat at each station, and which is worked with any ordinary single current key and without a transmitter, being the arrangement universally employed.

We must also point out that your system is almost absolutely identical with that of D'Infreville, which is described in the number of the Journal for April 1st, 1878, and which latter system is itself absolutely identical with that patented by Mr. G. K. Winter in 1873. The only point in which your system differs from those of the two gentlemen mentioned, is in the arrangement of the batteries. In your system the poles of the battery do not oppose one another as they do in D'Infreville's and Winter's system. This is the only point of difference, and it does not appear to us that your arrangement is an advantageous one, as the batteries are in full work when the line is not being operated.

No mention whatever is made of your duplex system, or of your method of testing in the book referred to.

PROPOSED INTERNATIONAL AGENCY OF ELECTRICITY.

A PROJECT originating with Count Hallez d'Arros is on foot in electrical circles in France, which has for its aim the establishment of an international electrical agency for encouraging the applications of science to practical life, and assisting their popular use by financial means. A museum of electrical apparatus, to which the public will have daily access to see the demonstrations, a library, a counting house and enquiry office, will be established in a central position in Paris, and the journal *l'Electricite* will give publicity to the results of the agency. The support of home and foreign constructors is requested; and any apparatus deposited by them in the museum will entitle them to a proportionate share in the concern. We gladly make known the scheme in England, and we shall give it all the co-operation that we can.

Reviews.

Electricity and Magnetism. By FLEEMING JENKIN, F.R.S.S., L. & E., M.I.C.E., Professor of Engineering in the University of Edinburgh. Fourth Edition. London: Longmans, Green, and Co. 3s. 6d.

PROF. FLEEMING JENKIN'S text book on electricity and magnetism is too well known to call for much remark from us. It is the work of an eminent electrician, and a writer who treats his subject in an original and masterly manner. All English electrical text books prior to its appearance fol-

lowed the same hackneyed groove, and employed the same familiar illustrations; but this of Prof. Jenkin, if it displayed and still displays marks of haste in its preparation, showed also a plan and treatment founded on an intelligent grasp of the whole subject, and not on an ingenious compilation. The new edition is an exact reproduction of former ones, with an appendix on the telephone and microphone added.

In referring to the fact that a very thick iron diaphragm will serve for the telephone, Prof. Jenkin says "The word *bend* may be quite inapplicable to such a case, but the surface opposite the magnet does certainly advance and recede, or it would not transmit sound to the air in contact with it. This alternate advance and recess would take place if instead of a $\frac{1}{8}$ plate we had a rod many feet or many yards long. A far more singular fact has been discovered by many observers, namely, that non-magnetic, and even non-conducting substances might be used instead of a ferrotype disc in the receiving instrument; and, lastly, that the receiving instrument will work, though very feebly, with no disc whatever. In this case it seems clear that the Page effect, as it may be called, *i.e.*, the noise made by the magnet itself as its particles rearrange themselves with each change of stress, is the source of the sound heard. This sound becomes articulate as soon as its increase and decrease follow the increase and decrease produced by the voice at the sending end. It is obvious that when the currents sent are those due to Bell's disc, the sound from the Page effect must approximately at least correspond with those which the ferrotype receiving disc would give off. Thus when the ferrotype receiving disc is present we hear at least two simultaneous voices, the voice of the disc, which is strong, and the voice of the magnet that is weak. When for the ferrotype disc we substitute a wooden plate, this plate will act as a sounding-board for the Page effect. When the plate is a conductor, currents will be induced in it by the change in the magnetic field, and these will tend to move the plate in such a way as to give a third source of sound which might be called the Ampère effect. A fourth source may be due to the sound produced in the wire itself as the current changes in intensity; this sound was first observed by M. Delarive, and his observations have been lately confirmed by Dr. Ferguson in Edinburgh."

This is all admirably clear and a good example of Prof. Jenkin's talent for expounding scientific results. We should have liked to give his account of the experiment of Mr. Gott at St. Pierre, in which the coil of a siphon recorder suspended in a magnetic field was used as a telephone, but we have not the space. In regard to the nasal tone of the telephone, Prof. Jenkin is of opinion that the disc fastened at its periphery is not free to follow the impulses of the voice with perfect truth, but has peculiar modes of vibration of its own which modify the sound. The disc, free at its edges in Niaudet's form of telephone, is a better articulator perhaps for this reason.

In speaking of the microphone, Prof. Jenkin cites Prof. Tait's calclulation that the telephone currents are a thousand million times less than ordinary telephone currents, and infers that if sound vibrations are employed to modify the resistance in a telegraphic circuit including a telephone, this telephone will produce a corresponding sound provided the change in resistance amounts to one-millionth of the resistance of the whole circuit—a fact which enables us to comprehend the marvellous action of the microphone and the Edison carbon telephone. By a singular omission no mention whatever is made of the microphone receiver of Prof. Hughes.

Le Telephone, le Microphone, et le Phonographe. Par LE COMTE THE DU MONCEL, Membre de l'Institut Paris Libraire. Hachette et Cie. Illustrated with 67 Woodcuts.

ANYTHING from the pen of Count du Moncel is sure to be first rate, and this latest volume of Hachette's *Bibliotheque des Merveilles* is no exception to the rule. The recent scientific marvels of which it treats have not had a more eloquent and enthusiastic expounder and student than him, and the best fruits of his literary art and scientific skill are to be found in this volume. He begins with the earliest history of the subject and ends with the latest theories and results. All the apparatus of the telephone, the newest forms of microphones and phonographs, are fully illustrated and described, and the explanation of the microphone, in which work M. du Moncel has had so large a share, is very full and exhaustive. We would recommend an early translation of this book into English.

Notes.

MR. EDISON'S representatives in this country are so inundated with letters of inquiry that it is almost impossible to open them.

WE have authority for stating that the Edison mode of electric lighting is by the incandescence of a resisting metal.

IT is proposed to bring out at an early date a large "Edison Electric Lighting Company," with a view to filling the *immediate* demand for electric light (until Edison's system is ready) with the other means at command.

THE TELEPHONE.—We are happy to see that the French Jurors have recognised Professor Graham Bell as the chief inventor of the speaking telephone by awarding him a grand prize.

WE hear that the Bell Telephone Company, London, are about to take action against the Carbon Telephone Company, London. The same company also give notice that they will require an annual payment of £2 per telephone (the first year to be paid in advance) from all parties using telephones without paying a royalty to the Company.

WE also learn from the *Operator*, U.S., that action has been taken by the Bell Telephone Company against the American Speaking Telephone or Gold and Stock Company, both of New York, to decide whether Pro-

fessor Bell's patents include the principles of the other telephones used by the latter company. The best patent lawyers in America have been retained on either side, Mr. E. N. Dickenson, of New York, who appeared for the Western Union in the recent quadruplex suit, and Mr. Chauncey Smith, of Boston, being for the Bell Telephone Company, and Mr. George Gifford, who acted for Professor Morse in his suits with Bain and others, being the leading counsel for the Gold and Stock. The suit is brought in Boston, the New York Courts being so charged with cases that the trial might be postponed for four or five years. Two months has been granted the Gold and Stock to file an answer, and the trial will then probably take place; but it is thought that the case will not be decided in less than two years. This trial will probably sift out the share of merit belonging to each of the claimants of telephone inventions.

AN improved mechanical telephone has been patented in America by Mr. Schuyler, S. Parsons, and others. It consists of a cloth or textile diaphragm mounted on an open wooden case. The main wire is connected to the diaphragm by a number of smaller branch wires. It is hung from insulators made of sheepskin, placed in a frame with a central opening, the frame and sheepskin being slitted, and the sheepskin strengthened at the slit.

IN our review of Professor Fleeming Jenkin's "Electricity and Magnetism," in this number, we give an interesting extract on the theory of the telephone.

IN the *Archives Neerlandaises, tome XIII., 3me liv.*, is to be found an account of experiments made to determine the strength of the currents traversing the circuit of a Bell telephone in action. A sound composed of 880 vibrations per second, causing the diaphragm to vibrate with an amplitude of one-thousandth of a millimetre, produced currents in the circuit whose intensity was equal to 0·0000792 electro-magnetic units. The resistance of the circuit was 70 Siemens' units. The results were determined by the decomposition of water. Sound waves executing 440 vibrations a second produce 880 currents a second, which are capable of decomposing 748 millionths of a milligramme.

THE following are the principal results of Mr. W. J. Miller's experiments on the mechanical transmission of sound by stretched wires and diaphragms, as published by him at the Dublin meeting of the British Association:—

In general, greater volume of sound accompanied increased depth of the rim or mouthpiece round the stretched diaphragm, but the sounds were hardly so distinct as when the rim was kept shallower.

The wire was usually attached to the centre of the disc, but in some cases good results were got when the wire was led through a cylindrical hollow piece of wood, and terminated *close* to the disc; indeed, a hollow piece of wood *without* a disc did very well. High-pitched voices are more easily heard than deep, strong voices. The wires (of copper) No. 23 and No. 40 as a rule required to be more or less tightened up to a degree varying with the heaviness of the wire. The sound is increased with a tight wire, and the volume of sound appeared to be increased with a heavy wire; thus with No. 8 telegraph wire the sounds were fuller and stronger than in thinner wires, and, probably owing to its high tenison, faint sounds were more readily transmitted. In all cases the individual voice could be easiiy distinguished, though modified more or less by the structure and material of the mouth and ear pieces.

THE MICROPHONE.—A very neat portable microphone has been devised by M. Trouvé, Paris. It resembles a small cylindrical hand lantern with a door in its side; the candle being replaced by the upright stock or pencil of carbon, which is supported by a carbon floor and ceiling.

AMERICAN makers are said to be shy of making microphones, because of Edison's carbon telephone patents. Yet very good proof of the novelty of the microphone to Americans is to be found in the fact that experimenters there are still being surprised over the earliest of its feats.

A MECHANICAL microphone, or rather telephone, is announced from Cincinnati. Mr. Israel D. Jewett, druggist, St. Omer, Indiana, has invented a contrivance called an "agaphone," which is said to be capable of transporting sounds, music, speech, and watch-ticks over a wire nearly half a mile long without the aid of electricity. It has not yet been patented, and the explanation is not forthcoming; but it may turn out to be an improved "string telephone."

THE PHONOGRAPH will henceforth be sold in America to all purchasers, without any royalty to the Phonograh Company, for 100 dols. (£5) or 200 dols. (£10), according to the finish of the instrument.

M. BOUILLARD, the eminent French *savant* who lately pronounced the phonograph a ventriloquial fraud and the microphone an acoustical humbug, has probably had his doubts set at rest, for at the *séance* of October 7th, Count du Moncel again exhibited the "singing condenser" and the phonograph before the entire Academy, leaving it to the members to make the experiments themselves.

THE TELEMACHON. — By his electric telemachon, Mr. William Wallace, electrical manufacturer, of Ansonia, Conn., U.S., is enabled to transmit power from the Naugatuck River to his factory, a quarter of a mile off, with a loss of some 20 per cent. of the current. The telemachon consists of a dynamo-electric machine, for transforming mechanical power into electricity, and an electric motor, which reverses this operation, and turns the current into power. It is this apparatus that Edison alludes to in his account of his plans with the electric light. As it exists at present, Mr. Wallace's dynamo-machine only feeds eight separate electric lights, each being reputed to equal 4,000 candles.

THE Liverpool city authorities intend applying to Parliament for powers to adopt the electric light for general illumination, and the contemplated purchase of the gasworks is put off.

LUMINOUS PAINT (Patent No. 4152, 1877).—W. H. Balmain involves the novel idea of mixing paints and varnishes with a phosphorescent salt (such as a mixture of lime and sulphur). This composition will store up daylight and give it out by night. Practically, Mr. Balmain applies it to clock faces, but his patent claims its use for all kinds of lighting purposes. Rooms may be painted with and streets coated so as to become self-luminous, ships' buoys, and all manner of things.

THE *American Gas-light Journal* thus paraphrases the report of Mr. G. H. Stayton, the surveyor of the Chelsea Vestry, on the electric-light: "When electricity can supersede gas as a means of illumination, both in price and quality of light, it will probably be adopted." Probably.

HANLEY SKATING RINK has again opened for the season, with an electric light of 500 candle power, costing only 3d. per hour.

WE are glad to learn that Dr. Alexander Muirhead has obtained an excellent duplex-balance with Muirhead's Artificial Cable at the Madras end of the Eastern Extension Company's Madras to Penang Section. Dr. Muirhead is now on his way to Penang to establish the balance there, and so complete the arrangements for duplex working.

MR. THOMAS LETTS, the well-known stationer, of 72, Queen Victoria Street, has published a series of finely-executed maps, or charts, intended as a newspaper reader's companion, or index to "Useful Knowledge." There are 230 maps in the entire series, including maps of cities and special localities. The prices, mounted on cloth and unmounted, range from 2s. 6d. to 6d. From the specimens sent us, we should say that these handy maps will be of use and interest to many telegraph engineers.

THE TELEGRAPH TO THE CAPE.—The Legislature of Cape Colony has passed an act authorising the payment of a sum not exceeding £15,000 a year for fifteen years as a subsidy in aid of a line connecting England to the Cape, and Natal has agreed to pay a similar subsidy of £5,000 a year. Mr. Thomas Watson, President of the Cape Town Chamber of Commerce, advocates in the *Times* of October 28 a land line in preference to a cable. A land line from Khartoum to Port Durtan, Natal (2,500 miles as the crow flies), would, at £200 a mile, cost only half a million as against £1,200,000 for a cable, and would, he thinks, help much to suppress the slave trade and open up Central Africa.

THE underground cable from Strasburg to Kiel, 1,200 kilometres long, is now working with complete success.

A BURNT CABLE.—Of the many curious haps and mishaps that befall submarine cables it might be deemed that injury by fire is the most unlikely. Nevertheless, the P. O. Cable across the Firth of Forth, containing four conductors, was recently interrupted by a fault, found below high water mark, which had been caused by a fire kindled with shavings when the tide was low. The gutta-percha of the core was melted away leaving the conductors in contact with the iron sheathing.

A CABLE between Alsen, Schleswig, and Fühnen, Denmark, was laid on September 28.

A THIRD edition of Prescott's "Electricity and the Electric Telegraph" is now in the press, and a second edition of his book on the Telephone is also in preparation. A good deal of new matter will appear in these new editions, particularly on the Electric Light and the Carbon Telephone, which has recently been greatly improved.

THE Eastern Telegraph Company announce the extension of their submarine system to Cyprus. The cable has been successfully laid by the Telegraph Construction and Maintenance Company between Alexandria and Larnaca, and was opened for traffic on the 18th inst. This puts Cyprus in direct telegraphic communication with Malta, Gibraltar, and England; also with France, Italy, Greece, and Constantinople; and on the other side with Egypt and India. This company's recent extensions to Besika Bay, Crete, Constantinople and Cyprus have been established by agreement with her Majesty's Government, and are worked throughout by telegraphists under the company's control.

THE Cienfuegos to Santiago section of the Cuba Submarine Company's cables repaired last April is again interrupted, but traffic is kept up by the duplicate line.

THE Eastern Telegraph Company have sent out several hundred miles of cable with core sheathed in brass tape, to test whether or not it will withstand the teredo.

THE CASE OF MR. HERRING.—Mr. Richard Herring, of St. Mary's Road, Canonbury, is the spirited exponent, both in lectures and pamphlets, of his battles with what he calls the *vis inertia* of the postal telegraph authorities. As far back as 1870 Mr. Herring brought before the notice of the postal telegraph department an improved Morse which marked the slip transversely, thus condensing the message and saving paper. He was told that it must be made to emboss the paper before it could be tried. He made it do so, and the instrument was tried in January, 1871, but condemned because it did not mark the signals in ink. The ink-marking type was then tried before Sir William Thomson and Prof. Fleeming Jenkin in October, 1872; but Mr. Herring was dissatisfied with this trial, alleging that the referees did not keep to the terms agreed upon. A further trial by automatic sender was then suggested by Mr. Jenkin. Mr. Herring wished that Messrs. Clark, Forde, and Co., who had already reported favourably on the instrument, should be present at the trial in his favour, while the above-mentioned gentlemen represented the postal authorities. Mr. Scudamore agreed to this; but no such trial ever came off, although Mr. Herring had incurred considerable expense in preparing for it, and engaging Messrs. Clark, Forde, & Co. On July 4, 1874, Mr. Scudamore wrote to Mr. Herring that the experiments with his instrument had now ceased, and the department had decided not to use them. Thus the department seems to have broken its promise, and to have caused Mr. Herring considerable loss in time and money. It makes no offer to reimburse him, and the legal advice which he has obtained counsels him to the remedy of a petition of right against the Crown, and opines that it is a case for a jury, by whom substantial damages might be returned. Mr. Herring would, however, doubtless be satisfied by the trial formerly arranged for being faithfully carried out now.

IT is reported that the *Great Eastern* is to be employed in the transport of cattle from Texas to London. She will carry 2,200 head of cattle and 2,600 head of sheep.

PROFESSOR GRAHAM BELL (according to the *Scientific American*) thus writes to an American friend: "If you want to know the reason why inventors are more numerous in America than they are here, come and live for six months in England. If you wish to know how it feels to be brimful of ideas and yet to be unable to have one of them executed, come to England. If you wish to know how it feels to have to wait for a month to have the simplest thing made and then be charged a man's wages for two months, come to England."

THE BUNKUMPHONE.—The bunkumphone, of American origin, is an ingenious combination of the telephone, phonograph, and other *phono-grippes* designed for the

exclusive use of financiers. It consists essentially of a metallic disc in a state of excessive vibration, and having the property of putting in movement many other discs of the same sort in our continent of simpletons, and of attracting these European discs by an action as energetic as it is well dissimulated. This disc is actuated by submarine cables, the chief of which connects the City of New York with the Institute of France. The attracting disc is of silver, and it has the weight and external appearance of a dollar. The attracted discs resemble ordinary *cent-sous*.

This apparatus is being experimented upon at this moment with great success. They have shown us at the *Figaro* office this same bunkumphone as a marvel inexplicable as the mystic cabinet of the Davenport Brothers. We have dismounted the little machine, and after having seen what was inside, we have said:—"Gogo, friend Gogo, the Frenchman is a born fool, everybody knows that; but he hasn't quite got used to American humbugs. Gogo, beware!"—*Le Figaro*, Paris.

COMPOUND LIGHTNING.—Mr. E. H. Pringle, in a letter to *Nature*, October 3rd, states that "compound lightning flashes," or discharges, where several flashes follow each other rapidly in the same track, are to be seen in almost every tropical thunderstorm. When the flashes succeed each other quick enough, the effect is "beaded lightning." It is singular that the electricity should collect so rapidly; for the after-flashes do not seem to be merely residual.

LONGITUDE BY TELEGRAPH.—As a specimen of the precision now attainable in the determination of longitudes by galvanic signals, we may quote the three results, obtained at different times, and in different ways, for the difference of longitude of Greenwich Observatory and Harvard Observatory, Cambridge, Mass. They are as follows:—

	h.	m.	s.
In 1866, by Anglo-American Cables ...	4	44	31·00
In 1870, by French Cables, to Dixbury	4	44	30·99
In 1872, by French Cable, to St. Pierre	4	44	30·96

TOMMASI'S RELAY.—We recently gave an abstract of some experiments made by M. Tommasi on the Atlantic Cable taken from the *Comptes Rendus* (bulletin of the French Academy of Sciences), an authority which ought to be trustworthy. These results did not appear to us to form any practical test of the apparatus, but we gave them for what they were worth. Mr. Weaver, General Manager of the Anglo-American Telegraph Company, however, informs us that these results are erroneous, and that the relay was a complete failure. We are not surprised at this, for it ignores the essential fact of a varying zero in submarine telegraphy, and its much vaunted sensitiveness is only exhibited through resistance—induction being absent. We have condemned this relay before, and are now not sorry to be able to expose the hollowness of its pretensions for practical submarine work.

EFFECT OF PRESSURE ON DISRUPTIVE DISCHARGES IN AIR.—Mr. J. E. H. Gordon has been studying the effect of changing air pressure on the length of the electric spark. His apparatus consisted of an induction-coil giving a spark of 17 inches, and worked by 10 Grove's cells. The discharging tubes were 4 feet long and 3 in. diameter, with a stuffing-box at one end, in which a brass rod slid. The inner end of the rod was kept in the axis of the tube by 3 glass arms on an ebonite collar. The whole apparatus was insulated on ebonite legs. The tubes were connected with an air-pump, by means of an insulating glass tube. The pressure was given by a U gauge about 4 feet high, and the air dried by passing it through sulphuric acid. In the experiments, one tube was open to the atmosphere, and the discharging point kept at a standard distance from the ball. The other tube being nearly exhausted, experiments were begun at low pressure, a little air being let in between each observation. The discharging distance in the second was then adjusted to the shortest distance, which caused the whole discharge to pass in the first tube. On this being noted, the points of the second tube were again brought together, until the whole discharge passed between them. The mean distance of the two observations was taken. The results were:—

1. From a pressure of 11 inches upward the length of spark is inversely as the pressure.

2. Accidental circumstances materially modify the length of spark.

3. Below a pressure of 11 inches the spark is shorter than it should be by No. 1, the electro-motive force required to produce a spark of given length at low pressure being greater.

The last result agrees with Sir W. Thomson's experiments, which showed that greater electro-motive force per unit length of air is required to produce a spark at short distances than long ones. To this may now be added "and at low pressure than at high."

ELONGATION OF A CONDUCTOR TRAVERSED BY A CURRENT.—M. Blondlot has presented to the French Academy of Sciences an account of some experiments undertaken with a view to prove whether or not there is really an elongation of a wire when a current passes in it, as Edlund and Streinitz have believed and Wiedemann has denied. This method is designed to distinguish more clearly than heretofore between the effect due to heating and that due to the current. The principle of it consists in intercalating a thin metal ribbon in the circuit, by means of stout soldered connections. Any effect due to heating will dilate this ribbon both longitudinally and transversely, so as to increase its bulk without deforming it. But the current effect, if it take place, will do so unequally in the two directions, and will consequently deform the ribbon. Any misshaping of the metallic band or of figures traced on its surface ought therefore, M. Blondlot reasons, to be due to the current, and if there be none, such a direct mechanical action of the current does not exist. With the current from ten Bunsen cells no elongation could be detected, although the arrangement was capable of showing an elongation of 0·00000025m. per metre. Ribbons of brass, German silver, and other metals were experimented on, but with the same negative result.

ATMOSPHERIC ELECTRICITY.—In a recent memoir read before the Academy of Naples, Prof. Palmieri gives the results of his 27 years experience of this subject. He is of opinion that the formation of aqueous meteors and clouds is always attended by the liberation of positive electricity; but these clouds can afterwards change themselves negatively by induction. When negative electrification is observed, it is due to perturbations resulting from discharges at distances more or less great. In dry clear air where the distribution of positive electricity is normal, the potential diminishes with increasing height, a result different to that obtained by other observers.

CONDUCTIVITY OF SOME ELECTROLYTES.—M. Svenson (*Inaug Dissert Lund Suędois*) finds that the electric conductivity of solutions of sulphate of potash, sulphate of aluminium, the alums of soda, potash, ammoniate of iron, ammoniate of chronic (red and green), increases with the proportion of salts.

RESISTANCE OF THE ELECTRIC LIGHT.—Professor W. E. Ayrton and John Perry, of the Japan Imperial

Engineering College, find the resistance of the "voltaic arc" to be as follows:—

Number of Grove's cells in series.	Resistance of battery.	Mean resistance of arc.
60	12 ohms	12 ohms
80	16 "	20 "
122	24·4 "	30 "

The Grove cells employed were of the ordinary English rectangular form: the area of the platinum plate immersed being 13 square inches, and of the zinc plate 25 square inches. The arc was produced by a Dubosq's lamp. In these results the resistance of the arc increases more rapidly than that of the battery employed. If then the resistance of the electric light be found to increase proportionately to that of the battery, Messrs. Ayrton and Perry point out that it will follow that cells used for producing the electric should be all joined "in series," and no part in parallel circuit.

WE have received the following communication, which may have an important influence on gas shares:—

THE DAY-LIGHT STORER.—EDISON OUT-DONE.

"DEAR SIR,—For ten years I have been haunted by the idea of discovering a means of general illumination which will be within the reach of the poorest, and explode gas for ever. When I conceive a problem of this kind, I never rest until I solve it, and consequently I have never rested for ten years. The other day, while pacing my garden walk in the twilight, pondering this subject, I spied a glow-worm in the grass, and, involuntarily, I cried out, 'Eureka!' The idea had at length burst upon me. It is this. I prepare a phosphorescent salt of lime, which by day absorbs light, and by night gives it forth again, in a soft, diffused glow. I cause the walls of each room in a house to be coated with this salt, for domestic illumination, and I enact that all the houses lining a street be white-washed with it—so that as darkness comes on, the whole city, outside and in, shall be self-luminous. In this way I store up the light of day, and enable every man, for a few pence yearly, to be his own gas works, or his own electric light. The hideousness of night is banished; and burglars are unknown. I have patented this process in every civilised and uncivilised country, notably Africa, where, I imagine, the negroes will want to apply it to their persons. The nature of the salt will be revealed in due course."

It is, perhaps, necessary to say that this letter did not bear the American post-mark.

New Patents.

4007. "Mechanism and the working of electric clocks." R. H. BRANDON (communicated by C. H. Firnhaber). Dated October 10.

4011. "Arrangement of telephonic circuits." J. H. MCLURE. Dated October 10.

4016. "Electric lighting, &c." J. MUNRO. Dated October 11.

4022. "Improved arrangements for electric lighting." J. W. T. CADETT. Dated October 11.

4031. "Improved means of softening or diffusing the electric and other light." A. M. CLARK (communicated by L. Clémandot). Dated October 11.

4041. "A new and improved method of, and apparatus for, communicating rotary motion to hair brushes by means of electricity; applicable also to other purposes." W. NORTH. Dated October 12.

4043. "Improvements in the application of electricity to lighting and heating purposes and in the means or apparatus employed therein." ST. G. L. FOX. Dated October 12.

4046. "Obtaining electric light." G. P. HARDING. Dated October 12.

4047. "Obtaining electric light." G. P. HARDING. Dated October 12.

4066. "Magneto-dynamo-electric machines." J. IMRAY (communicated by the Société Générale d'Electricité). Dated October 14.

4074. "A mode of indefinitely dividing electric currents." A. ARNAUD. Dated October 14.

4075. "Galvanic batteries." J. H. JOHNSTON (communicated by W. W. GRISCOM). Dated October 14.

4079. "An improved translucent medium for reflecting, refracting, and diffusing light, capable of application to various other purposes." J. L. PULVERMACHER. Dated October 14.

4094. "Improvements connected with means and apparatus for the production, application, and regulation of electric currents." J. L. PULVERMACHER. Dated October 15.

4095. "Galvanic batteries." F. H. W. HIGGINS. Dated October 15.

4100. "Improved means of producing electricity and the electric light." F. H. VARLEY. Dated October 15.

4114. "Improvements in the method of dealing with electric currents, whereby they may be divided and distributed through any required number of circuits for lighting and other purposes. E. J. C. WELCH. Dated October 16.

4116. "Electric lightning." G. FORBES. Dated October 16.

4132. "Improvements in or applicable to electric lighting apparatus." A. S. HICKLEY. Dated October 17.

4140. "Electrical apparatus." W. SCOTT. Dated October 18.

4163. "Improvements in the application of electricity, being an imperishable substitute for carbon, and especially adapted to illumination." (J. N. ARONSON, H. B. FARNIE). Dated October 18.

4161. "A commutator for double transmission and reversion of current with contact to earth for submarine telegraphy. E. EDMONDS (communicated by le Comte E. Siccardi). Dated October 18.

4180. "Producing light by electricity."

4208. "Improved means and apparatus for electric illumination." C. W. SIEMENS. Dated October 22.

4212. "Lighting by electricity." C. T. WRIGHT. Dated October 22.

4226. "Method of and means for developing electric currents and lighting by electricity." T. A. EDISON. Dated October 23.

4231. "Apparatus for the increase and diffusion of all kinds of artificial light." F. YOUNG, C. M. DALE. Dated October 23.

4278. "Improvements in apparatus for dividing and distributing or for collecting electric currents for lighting and other purposes." E. J. C. WELCH. (Complete.) Dated October 25.

4283. "Improvements in obtaining light by electricity, and an apparatus for its application to illuminating purposes." J. E. STOKES. Dated October 25.

4290. "Improvements in the means or apparatus for igniting, regulating, and extinguishing the lights in streets and other lamps." G. GALE. Dated October 25.

4304. "A method of dividing and distributing the current produced by magnetic batteries and magneto and dynamo-electric machines into an indefinite number of separate currents equal or relatively unequal to each other in quantity or force." C. E. SHEA. Dated October 26.

4313. "Improvements in obtaining electricity and in the application thereof to the electric light and to other useful purposes." A. A. COCHRANE. Dated October 26.

4315. "Apparatus for producing light by electricity." B. P. STOCKMAN. Dated October 26.

4317. "Lamps for lighting by electricity." F. D. TILLEARD. Dated October 26.

ABSTRACTS OF PUBLISHED SPECIFICATIONS.

240. "Electric lamps." E. T. HUGHES (communicated by W. Wallace, Ansonia Co., Conn., U.S.). Dated January 18, 1878. 4d. This consists of an electric wick which dispenses with a regulator for adjusting the carbons. The carbons are in the middle of two slabs, having sharp edges parallel to each other. The arc is started at one corner of the slabs and travels along the edge till it arrives at the other corner, then comes back again, and so on, the edge of the positive carbon being eaten away and the new arc forming itself where the resistance between the wicks is less than before. A full description of this lamp is given on another page.

251. "Electric telegraph conductors." C. W. SIEMENS. Dated January 19, 1878. 6d. This consists in a means of protecting the cores of cables by enclosing it in a sheathing of metal tape, the outer sheathing of hemp and wire being applied over all where required. The tape, which may be of copper, is applied by a revolving bobbin or bobbins so that each turn of it overlaps on the last, and it is closed up by being passed through a die or between grooved pressing rollers. Conductors of large core for conveying electric light currents are advantageously sheathed in this manner, the sheath acting as a return wire.

275. "Semi-automatic apparatus for transmitting telegraph messages with the Morse system." T. J. SMITH (communicated by M. le Comte Emile Siccardi, Turin, Italy). Dated January 19, 1878. 10d. This consists of a sending key with two finger levers, one for dots and the other for dashes, whereby the duration of the dot and dash signals is automatically controlled, independently of the clerk.

291. "Communicating signals on telephonic circuits." JOSEPH HENRY MCLURE. Dated January 23, 1878. 6d. This consists in a combination of the telephone and telephone call whereby the mere position of the telephone operates the switches so that the call bell is alone in circuit, or the telephone, or both, as the case may be. In one form of telephone under this patent the call bell circuit is closed by touching a press button on the stem of the telephone, and the bell sounded.

307. "Telephones." DANIEL PIDGEON. Dated January 23, 1878. 2d. This describes a magneto-electric telephone call, combined with the telephone itself. The magnet of the telephone can be made of a horseshoe form, and a small coil rotated by hand is placed between the poles as the armature in which are generated the magneto-electric currents. The current is rapidly interrupted and the effect is to cause the distant telephone to give out a loud sound. Thus the "call" forms part of the telephone itself and no battery is required. *Not proceeded with.*

308. "Galvanometers, &c." L. A. BRASSEUR and M. S. W. DE SUSSEX, Brussells. Dated January 23, 1878. 6d. This consists in a relay for long submarine cables, which combines with the needle or the galvanometer a device which will close a local circuit at every increase of the line current, whatever be the last position of the needle of the galvanometer. The needle carries a light cross arm, from one end of which a vane dips into a pan of fluid, and from the other end a point is brought very close to the surface of a pan of mercury. The local battery is connected up to these fluids, and the least motion of the needle causes the point to make contact with the mercury, thereby closing the local circuit through the cross arm.

312. "Submarine telegraph cables." HENRY CLIFFORD. Dated January 23, 1878, 4d. The object of this is to guard the cores of submarine cables from insect ravages. A riband of felt, calico, or other fibrous material is coated with a mixture of resin, resin oil, or marine glue, and while soft it is caused to adhere on one or both sides to wire gauze, sheet brass, or Muntz metal, &c. It is then cut into tapes, which are laid round the core helically so as to overlap. The metal should be entirely covered with the tape, or pitch, or oil. The ordinary sheathing is then applied.

375. "Manufacture of insulated telegraphic conductors."—EDWIN T. TRUMAN. Dated January 29, 1878. 4d. This consists in enclosing india-rubber core in a lead tube, then turning it into vulcanite by heat and pressure. In this way a flexible vulcanite core is produced. Paraffin, ozokerit, or other waxes may be used to mix with the india-rubber, the compound being afterwards vulcanised. Gutta-percha and balatah may be also used in place of or along with rubber. The lead or other flexible material may also be used to cover other hard and brittle coverings, such as parkesine.

405. "Apparatus for reproducing musical and other sounds by electricity." A. M. CLARK (communicated by C. L. Weyher, Paris). Dated January 30, 1878. 2d. A simple make and break musical telephone is here described with a diaphragm for transmitter and electro-magnetic receiver. *Not proceeded with.*

408. "Controlling and localising electric currents." LUIS DE BEJAR Y O'LAWLOR. Dated January 31, 1878. 10d. This consists of a modification of the auto-kinetic system (described in patent No. 1303, 1876), whereby a number of radial stations can communicate with a central station without interference or tapping of the message.

City Notes.

Old Broad Street, October 30, 1878.

The tenth ordinary general meeting of shareholders of the Brazilian Submarine Telegraph was held on the 25th inst., at the Cannon-street Hotel; the Right Hon. Viscount Monck in the chair. The report stated that the Directors recommended the declaration of a final dividend of 2s. 6d. per share, making a total dividend of 5 per cent. for the year. This would absorb £16,250, leaving a balance of £55,675. Of this amount £50,000 had been placed to the reserve fund, increasing that fund to £170,000, and £5,675 had been carried forward. The Chairman said there were three questions with which they had to deal. First, the gross income; second, the expenses; and third, the net income. The income for the half-year with which they were

now dealing was £72,086, as compared with £66,028 in the last half-year, which showed an increase of £6,058. That was, however, hardly a fair comparison to make, as experience showed that the second half-year was usually less productive than the first. As compared with the first half of 1877 the increase was only £1,976, but that was so far satisfactory, because it showed that, notwithstanding the long-continued depression in trade, the traffic of the company had increased to a considerable extent. The increase of £315 on the expenses was due to the fact of their staff having taken the furlough with a free passage home after five years' service, which was in accordance with the agreement under which they were engaged, and after the uniformly good conduct of that staff he did not think shareholders would begrudge that expense. The manner in which the balance was disposed of, after paying 5 per cent. dividend, was by adding to the reserve fund, so as to render the 5 per cent. perpetual, and he did not think 5 per cent. in perpetuity a bad return for money invested. At any moment, also, they might be called upon to repair the shore end of the cable at Lisbon, and Directors were anxious to retain in hand sufficient funds to pay for that outlay. The question of their right to suspend the payment of their thirds under the agreement with the Western Brazilian Company was at present in dispute. Nothing had been paid under this head since February last, and the money had been carried into the accounts of the Company. The construction of the contract was a matter for lawyers, and they, therefore, thought it wise to retain possession of a sum of money to enable them to pay the Western Brazilian Company their thirds, should the matter be decided in that Company's favour. He moved that the report be received and adopted. Sir James Anderson seconded the motion, which, after some discussion, was carried unanimously.

The third ordinary general meeting of the members of the West India and Panama Telegraph Company was held on the 23rd inst., to receive the report and accounts for the six months ending June 30th last, and to declare dividends. Mr. C. W. Earle in the chair. The report and accounts having been taken as read, the Chairman in moving their adoption said: The revenue account now presented showed a greater balance of earnings over expenditure than was shown by any previous accounts. But in considering the accounts and inquiring whether it was thoroughly satisfactory as regarded the progress of the Company, there were some features which would not altogether afford a satisfactory reply to that question. It would be observed that the expense of repairing the cables was very much below what it had hitherto been. The average cost of repairs of cables was about £5,000, but this half-year they were something under £2,000. The difference between these two figures turned the scale, and made what would otherwise not have been such a good report, the best the Directors had presented. The cost of repairs was not under control and quite depended upon the winds and the waves. As to the items in the expenditure account, it was satisfactory to observe that there was a general and substantial decrease in them, which could only be attributed to constant watchfulness upon the general management of the company. Every item, indeed, was carefully checked. On the other side of the account there was, as noticed in the report, a falling off in the receipts, which was no doubt partly attributable to the very general depression of trade. That might of course only be a passing influence, and the tide must turn sooner or later, and then the Company would recover what they had lost under that head. With regard to the "coding" of messages, he feared there was little hope of improvement in the receipts of the Company being effected by that system. On applying to the colonial authorities, as an inducement to them to grant the largely increased rate, the company offered to reduce the minimum from ten words to one, and charge by the word; and it was very questionable, if that concession had not been offered, whether the company would have been allowed to increase the rate. However, the system of coding had been brought to such a pitch of excellence that the average number of words in a message had fallen off very much, although every means had been taken to see that their agents did their work properly. A statement had been prepared, which any shareholder could see at the company's offices, as to the amount of work they had to do in the West Indies. This was the second time since the present Board had been in office that the half-yearly meetings were connected with events in the West Indies, which caused a good deal of alarm and excitement. Two years ago, while sitting in that room, the Directors, and the Government also at the same time, were receiving telegrams as to the state of affairs in Barbadoes, where the negroes were then rioting and doing damage; and in the beginning of the present month a similar occurrence took place in a Danish colony in the West Indies. The details were not yet known, but they had heard enough to know that their telegraph had been instrumental in saving the property and perhaps the lives of a great many people.

By the Company's Cable the Governor of St. Thomas had been summoned, with his soldiers and men-of-war, to protect women and children and property from the pillage that was going on. Considering the important services the Company rendered to the Colonies, it seemed almost ridiculous that the Board should from time to time have to meet the shareholders with the payment of 1 per cent. dividend only and a very inadequate reserve fund. The Company had originally been formed with a capital of £660,000, which was now nearly doubled, the Company having been afterwards induced to include a greater number of islands and it having been found necessary in consequence to duplicate the system of cables. He considered, however, that that capital had been usefully augmented, and the colonists had no cause to complain of the company. The average revenue per mile of the six principal cable companies was 39·5 per mile, while this company's was 38·19, and that was really the cause of the company's present position, and it was not a revenue adequate to keeping up a proper reserve fund. A representation to this effect had been made to the Secretary of State, who had promised to give the matter full and fair consideration. He (the Chairman) then moved:—"That the directors' report and accounts to the 30th June, 1878, be, and they are hereby adopted, and that dividends be declared payable as follows—namely, on First and Second Preference Shares at 6 per cent. per annum, and on the ordinary shares 1 per cent., free of income-tax. —Mr. Ford seconded the resolution.—The Chairman, in reply to Mr. William Abbott, stated that one satisfactory feature in the code system was that it was helping the mercantile public in the West Indies, but he regretted the constant and regular decrease from month to month under that system which was working prejudicially to this country. With reference to the Central American Company, the lines opened by that company and the South American Company were so far from being perfect that if the Central American Company were resuscitated it would not be of much use, and the board had not hitherto been able to make any progress in that direction. The Chairman also said in the present state of matters the company would not gain by laying their own cables, as the lines of the Central

American Company were all broken down.—The resolution was then carried unanimously, and a vote of thanks to the Chairman terminated the meeting.

The report of the directors of the Eastern Extension, Australasia, and China Telegraph Company states that the gross earnings of the Company for the half year have amounted to £135,482. The working expenses, cost of repairs and maintenance of cables, new land lines and instruments for the establishment of duplex working on the Madras-Penang Cable, payment of income tax, interest on debentures, &c., amounted to £61,222, leaving a balance of profit for the half-year of £74,260. Two interim dividends of 1¼ per cent. each, amounting to £49,937 10s., have been distributed, leaving the sum of £24,323 to be carried forward to the next half-year. The Telegraphic Conference, referred to in the last report, was held at Melbourne in May last, when the question of duplicating the Australian cable was fully discussed, the result being that the Governments of Victoria and New South Wales were empowered to enter into an agreement with the Company for a second cable between Singapore and Australia for an annual subsidy of £32,400, payable for twenty years. Negotiations have since been carried on with the representatives of the Governments, which the directors have the satisfaction of stating have resulted in an agreement on the above basis, the terms of which will be submitted for confirmation to the extraordinary general meeting to be held at the conclusion of the ordinary general meeting, together with resolutions empowering the directors to carry the same into effect. The importance of this duplication as a protection of the Company's traffic will, it is believed, be apparent to the shareholders. The fresh capital required is £660,000, which the directors propose to raise by the issue of debentures redeemable within twenty years. The meeting is announced for the 6th prox.

The annual report of the Western Union Telegraph Company shows the business of the year has resulted in revenue accruing to the company 9,335,810 dols., expenses, 6,173,810 dols. The net profits (after reserving amount sufficient to meet the claims of the Atlantic and Pacific Telegraph Company under existing agreements) being 3,161,999 dols. This has been applied in four quarterly dividends of 1¼ per cent. each, to interest on debt 453,741 dols., to sinking fund appropriations 79,970 dols., leaving surplus of net revenue for the year over dividends, interest, and sinking fund appropriations of 524,561 dols. From this surplus there was appropriated for construction of new lines and erection of additional wires 216,320 dols., for purchase of sundry telegraph stocks (other than Atlantic and Pacific), patents, &c., 44,758 dols., the balance of 263,482 dols., together with the balances of previous years, being applied to the amount due on account of the purchase of the Atlantic and Pacific Telegraph Company's stock.

The Eastern Telegraph Company announce the extension of their submarine system to Cyprus. The cable has been successfully laid by the Telegraph Construction and Maintenance Company between Alexandria and Larnaca, and was opened for traffic on the 18th inst. This puts Cyprus in direct telegraphic communication with Malta, Gibraltar, and England; also with France, Italy, Greece, and Constantinople; and on the other side with Egypt and India. This company's recent extensions to Besika Bay, Crete, Constantinople, and Cyprus have been established by agreement with her Majesty's Government, and are working throughout by telegraphists under the company's control.

"We have received," says the *Daily News* of October 23rd, "the following from the secretary to the Eastern Extension Telegraph Company, and trust that the hopes held out will be realised, for the necessity of duplicating the present service with the Australian colonies is paramount:—'Referring to the paragraph in your money article of to-day, giving a quotation from the *Melbourne Argus* of the 2nd September to the effect that the negotiations with this company for the proposed duplicate cable to Australia had been broken off, I beg to inform you that the difficulties therein referred to have since been removed. We have to-day heard from Colonel Glover, the company's representative in Australia, that he expects to be able to advise us in a day or two of the ratification by the various Legislatures interested of the contract for the duplicate cable.'"

The *Daily Telegraph* reports that Sir Henry Layard has applied to the Porte for authority to lay a cable between Cyprus and Beyrout.

The Secretary of the Telegraph Construction and Maintenance Company Second Bonus Trust notified that the seventh distribution will be at the rate of 2s. 3d. per £5 certificate, and will be paid on and after Nov. 1, on presentation of Coupon No. 7, at Messrs. Barclay, Bevan, and Co.'s, 54, Lombard Street.

The fall in the prices of gas shares since our last issue has again been considerable, and the principal stocks show a depreciation of about 15 to 20 per cent. when compared with prices a month ago. To-day Gas Light and Coke "A" Ordinary fell 5, to 135, 145; ditto, Five per Cent. "A," Fourth Issue, ½, to 12, 13; Imperial Continental, 5, to 135, 145; and Bombay, ½, to 4, 5.

The electric light continues its steady progress. Mr. E. J. Reed, writes to a contemporary, that "A powerful company is in course of formation, and will be registered without delay, to be entitled 'The National Electric Lighting Corporation, Limited,' for the purpose of supplying the Rapieff and other systems of electric lighting." This news will hardly tend to an improvement in the value of gas shares. Mr. Reed's friend, Mr. C. Noel Hoare, of 25, Abchurch-lane, E.C., has been good enough to undertake to act on his behalf until his return from Japan (whither an official engagement calls him), and he, Mr. Hoare, will be happy to attend to the communications of all those who may desire to interest themselves in this public question.

The following are the late quotations of telegraphs:—Anglo-American, Limited, 58-58½; Ditto, Preferred, 84⅞-85¼; Ditto, Deferred, 32-32½; Black Sea, Limited, 2-3; Brazilian Submarine, Limited, 6⅜-6⅝; Cuba, Limited, 7⅜-8¼; Cuba, Limited, 10 per cent. Preference, 15¼-15⅜; Direct Spanish, Limited, 2-2⅛; Direct Spanish, 10 per cent. Preference, 10-10¼xd.; Direct United States Cable, Limited, 1877, 12¼-12⅜; Eastern, Limited, 6⅞-7⅛; Eastern, 6 per cent. Debentures repayable October, 1883, 107-110; Eastern 5 per cent. Debentures repayable August, 1887, 98-100; Eastern, 6 per cent. Preference, 11¼-11½; Eastern Extension, Australasian and China, Limited, 6⅞-7⅛; Eastern Extension, 6 per cent. Debenture, repayable February, 1891, 105-108; German Union Telegraph and Trust, 7⅜-8¼; Globe Telegraph and Trust, Limited, 4¾-5; Globe, 6 per cent. Preference, 10¼-10⅜; Great Northern, 7⅜-8; Indo-European, Limited, 19-20; Mediterranean Extension, Limited, 2¼-3; Mediterranean Extension, 8 per cent. Preference, 9¼-10; Reuter's, Limited, 10-11; Submarine, 215-220; Submarine Scrip, 2-2⅛; West India and Panama, Limited, 1⅞-2⅛; Ditto, 6 per cent. First Preference, 8-8¼; Ditto, ditto, Second Preference, 8¼-8⅜; Western and Brazilian, Limited, 2⅜-3; Ditto, 6 per cent. Debentures "A," 85-90, Ditto, ditto, ditto, "B," 86-89; Western Union of U.S. 7 per cent., 1 Mortgage (Building) Bonds; 114-118; Ditto, 6 per cent. Sterling Bonds, 101-103; Telegraph Construction and Maintenance, Limited, 29-29½; Ditto, 6 per cent. Bonds, 100-103; Ditto, Second Bonus Trust Certificates, 2⅛-2¼; India Rubber Co., 29½-30½.